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BASIN RANGE TYPES

By Professor W. M. DAVIS

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DURING the first 30 years following Gilbert's explanation, offered in 1874,[1] for the mountains of the Basin and Range province as dissected fault blocks, the evidence of their uplift on faults was physiographic in the sense of being dependent on facts of surface form; namely, a simple base line indifferent to the structure of a range-block along at least one of its sides. The evidence was all the better if post-faulting erosion had advanced so little as not to have altogether destroyed those modified remnants of the fault face seen in the spur-end facets by wearing them too far back from the initial fault plane; it was all the worse if post-faulting erosion had advanced so far as not only to consume the spur-end facets, but also to wear the mountain face well back from the fault trace and thereby give it an irregular base line. Physiographic evidence of faulting would then be lost and the origin of a range so much eroded would remain, as far as such evidence goes, uncertain.

The second 30 years of the Basin Range problem was opened by Louderback's account of the Humboldt Lake ranges of northwestern Nevada,[2] which proved their fault-block origin by evidence of a geological nature, in the sense of involving the repetition of a similar structural sequence in two adjacent ranges. This evidence was all the better if the structural sequence was highly specialized; all the worse if it were not. In the case that Louderback brought forward, the sequence involved a body of compressionally deformed and well-worn-down strata unconformably covered by lava sheets of prefaulting eruption, the lava sheets and the surface of erosion on which they rest unconformably dipping in the same direction

[1] G. K. Gilbert, Wheeler Survey, Progress Report, 1874, 50; also, *ibid.*, Vol. 3, 1878, 735, 744.

[2] G. D. Louderback, Basin Range structure of the Humboldt region [Nevada]. Bull. Geol. Soc. Amer., 15, 1904, 289–346.

in the two ranges; and that sequence has, I believe, been regarded by most American geologists as sufficiently specialized to lead them to accept faulting as the cause of its repetition. But such evidence of faulting would be wanting in ranges that have no lava cover on their back-tilted slope.

Many Basin Ranges have been much eroded since their upheaval or have been upheaved without previously receiving an unconformable lava cover, and the origin of such ranges is uncertain. But as all the ranges that have not suffered erosion enough to give them an irregular base line or that possess an unconformable lava cover are thereby shown to be fault blocks, that origin is, to say the least, rather probable for their less communicative neighbors also. Such origin may very probably be either proved or disproved for the taciturn ranges by modern geophysical methods in the third 30-year period of Basin Range study.

A simplified historico-explanatory terminology that I proposed for fault-block Basin Ranges seven years ago[3] is as follows: The mountains which occupied the Basin and Range province in Cretaceous time were shown by the geologists of the Fortieth Parallel Survey[4] to have been produced by compressional deformation; they may be called the King Mountains, after the director of that survey. The surface of generally low relief to which these mountains were reduced by erosion in later Cretaceous and Tertiary time may be named after Powell, who first inferred its occurrence in 1876.[5] Curiously enough, Gilbert overlooked this important contribution of his senior,[6] in spite of the intimate terms on which the two worked together for many years in Washington, and attributed it to Dutton, who, although he announced it more explicitly than Powell did, was 12 years later in making the announcement.[7] The uplifted and more or less tilted blocks may be called Gilbert blocks, their initial back slope being a part of the Powell surface and their front face originating as a fault scarp; both back slope and front face now being less or more modified by erosion consequent upon faulting.

Wherever the Powell lowland happened to be unconformably covered by a lava sheet, a fault block there uptilted would have a back slope as revealing as it is enduring, and such a back slope should be called a Louderback. And it may be further specified that wherever the Powell surface happened to have been covered by an unconformable series of imperfectly consolidated strata (often including much volcanic ash and erroneously called "lake beds" by earlier observers in accordance with the views of their time, but more probably representing subaerial deposits that accumulated where a moderate down-warping of the Powell surface received the wash of detritus from up-warped areas), these weak strata are soon stripped from the back slope of upfaulted range blocks and reduced to relatively low relief in the inter-range depressions, where they constitute weak-rock pediments, to the occurrence of which Blackwelder has recently given special attention.[8] Also, wherever the period of mountain upheaval is so remote that a good share of the deformed and resistant rocks of a range have come to be consumed under the arid conditions there obtaining, the residual mounts are surrounded with a hard-rock floor or pediment, such as has been described and explained by McGee, Paige, Lawson, Bryan and others.[9] Some simplified diagrams of several of these varied forms are given in one of my recent papers.[10]

The above scheme of explanatory description has been criticized as too simple by certain observers familiar with the geological history of the Basin and Range province; and it is too simple, geologically speaking, for the occurrence of later geological movements than those which produced the King mountains is eminently possible; and some account of such movements, Miocene in date and fairly strong in measure, has indeed been lately given me personally by H. S. Gale. But the scheme is less condemnable physiographically, for a physiographic scheme need take account only of those past occurrences which are of importance in explaining the visible forms of to-day; and from that point of view the original statement of the scheme need be modified only so far as to say that not only the King mountains but also any other mountains of later production were rather effectively consumed in the production of the prefaulting Powell lowland. It must be understood, however, that the lowland was hilly, even submountainous, in certain areas, as in parts of southeastern Arizona, referred to below.

[3] W. M. D., "The Basin Range Problem," Proc. Nat. Acad. Sci., 11, 1925, 387–392.

[4] Fortieth Parallel Survey, Vol. 3, 1870, pp. 2, 451.

[5] J. W. Powell, "Geology of the Uinta Mountains," 1876, 32.

[6] G. K. Gilbert, "Studies of Basin Range Structure," U. S. Geol. Surv., Prof. Paper 153, 1928; see p. 3.

[7] C. E. Dutton, "Geology of the High Plateaus of Utah," Washington, 1888. See p. 47.

[8] Eliot Blackwelder, "Origin of Desert Basins of the Southwestern United States," Bull. Geol. Soc. Amer., 39, 1928, 262–263.

[9] W. J. McGee, "Sheetflood Erosion," Bull. Geol. Soc. Amer., 8, 1897, 87–112; Sidney Paige, "Rock-cut Surfaces in the Desert Ranges," Jour. Geol., 20, 1912, 422–450; A. C. Lawson, "The Epigene Profiles of the Desert," Univ. Calif. Geol. Bull., 9, 1915, 23–48; Kirk Bryan, "The Papago Country, Arizona," U. S. Geol. Surv., W. S. Paper 499, 1925.

[10] W. M. D., "Physiographic Contrasts, East and West." *Scientific Monthly*, 30, 1930, 394–415, 500–519.

During the past seven years I have had opportunity of seeing a number of Basin Ranges in the arid region of the Southwest, and have found it profitable to collect examples of fault-block ranges that have individual physiographic peculiarities of one sort or another, apart from a vast variety of structural peculiarities and of differences in length and height. Here are to be included, for example, more or less manifest spur-end facets at the base of the dissected fault-scarp front of a range, or a more or less extensive Louderback on the back-tilted slope. The collection now includes the following examples.

First, the short Peacock Range in Arizona, next west of the Grand Wash cliffs in which the plateau trenched by the Colorado Canyon is terminated by down-faulting; this range being peculiar in having only a pair of tell-tale little Louderbacks at the end of two of its many back-sloping spurs;[11] second, the northern part of the Oquirrh Range in western Utah and, third, parts of the Panamint Range in southeastern California, which are alike in having suffered a pronounced second upfaulting of 1,000 feet or so, whereby the valleys maturely eroded in the first-formed fault scarp now stand in a hanging position above their downfaulted fans, over which small new fans are forming; the hanging valleys and the new fans being connected by sharp-cut, fault-face gorges.[12] These two examples are further peculiar in showing, not mere spur-end facets as modified remnants of their initial fault face, of which the best examples I have seen are, fourth, in the Spanish Fork section of the Wasatch Range of Utah, but large parts of their new fault faces, little modified. Fifth, the House Range of southwestern Utah,[13] which like most of the other Basin Ranges has been so much eroded that it has lost its spur-end facets, although the base line drawn along the rounded ends of its retreating spurs is of simple pattern and still very clearly transects the deformed structures of the range block: this range has, moreover, a historic interest as it appears to be the one which first gave Gilbert the idea of a tilted fault block.

Sixth, is the trebly peculiar Galiuro Range in southeastern Arizona, first in having a markedly uneven Powell surface, second in having something like 2,000 feet of lavas in its heavy and gently inclined Louderback, third in showing a renewed movement of upheaval but without renewed faulting; for here the detritus outwashed from the fault-scarp valleys of the first movement has been raised with the range instead of depressed from it in the second movement.[14] Seventh, come the Bear River mountains of northern Utah, in part of which the downfaulted block has not sunk out of sight, so that the valleys eroded across both blocks give exceptionally good opportunity of determining the dip of the fault surface between them, which proves to have the low value of from 35° to 30°.[15] Eighth, are the Santa Catalina Mountains of southeastern Arizona, which are believed to be of fault-block origin because of the transection of their deformed structures by their relatively simple southern and western base lines, and which, after reaching a sub-mature stage of erosion consequent upon a first uplift, have later suffered an upheaval of 1,000 feet or more in their northern or back slope, thus gaining a hump-backed quality.[16] Ninth, come the Sierrita Mountains near Tucson in southeastern Arizona which are not proved to be of fault-block origin, but around which a rock floor or pediment has been developed such as should have been developed around a fault-block of somewhat remote date of uplift.[17] And tenth is a remarkably perfect granite dome, also not proved to be of fault-block origin, which may take the name of Cima (Spanish for summit) from a near-by railroad station in a pass at the southern end of the Ivanpah Range in southeastern California. This dome has been instanced by Lawson as a type of what he has called a panfan in the sense of being the form to which an upfaulted mass of granite would be reduced in the penultimate stage of a cycle of arid erosion.[18]

The eleventh and latest addition to the collection is the Argus Range, the second Basin Range east of the southern end of the Sierra Nevada in southeastern California. It was first seen to be Louderbacked over several square miles in the southern part of its eastern slope when I passed along that part of its base in company with Dr. L. F. Noble on my first trip to Death Valley in the spring of 1925. The northern end of the range was crossed with the same companion on a second Death-Valley trip a year later, when not only the eastern or back slope was seen to be irregularly Louderbacked, but the western or fault face was found to exhibit a series of down-stepping, lava-capped fault slabs of very convincing appearance; they are figured in outline in the account of the Peacock Range, above cited. But a long and high middle

[11] W. M. D., "The Peacock Range, Arizona." Bull. Geol. Soc. Amer., 41, 1930, 293–313.

[12] W. M. D., "The Basin Range Problem," Proc. Nat. Acad. Sci., 11, 1925, 387–392.

[13] W. M. D., "The Wasatch, Canyon and House Ranges, Utah." Bull. Museum Comp. Zool., 40, 1905, 17–56; see pp. 19–21.

[14] W. M. D. and Baylor Brooks, "The Galiuro Mountains, Arizona." *Amer. Jour. Sci.*, 30, 1930, 89–115.

[15] R. W. Bailey, "The Bear River Range Fault." *Amer. Jour. Sci.*, 13, 1927, 497–502.

[16] W. M. D., "The Santa Catalina Mountains, Arizona," *Amer. Jour. Sci.*, 22, 1931, 289–317.

[17] W. M. D., "Rock Floors in Arid and in Humid Climates." *Jour. Geol.* 38, 1930, 1–27, 136–157.

[18] A. C. Lawson, "The Epigene Profiles of the Desert." Univ. Calif. Geol. Bull., 9, 1915, 23–48.

section of the eastern slope, of which I had a good view in 1931, in company with a former student, Samuel Storrow, of the Harvard class of 1887, now a retired engineer in Los Angeles, is without a lava cover, and taken by itself affords no satisfactory evidence of its manner of upheaval.

Since then I have secured from R. W. Mumford, chemical engineer of the American Potash and Chemical Company at their works at Trona on the saline sheet known as Searles Lake, next east of the southernmost part of the range, several airplane photographs, and some of these show a typical Louderback of small area at a considerable altitude, about midway between the eastern and western margins of the range. This spring I have been fortunate enough to visit that isolated lava sheet, again in company with Mr. Storrow and under the guidance of Mr. Mumford, whose car carried us along a rough road up a submature valley eroded in the western or fault front of the range, where no traces of spur-end facets survive. We drove to within half a mile of the lava cap, so that we had to make but a short distance on foot before reaching its long, smooth surface.

The view there disclosed was notable in several respects. It was of course a treeless view, although a good part of the surface is occupied by the spaced growth of bushy, knee- or waist-high vegetation, with the 5- or 6-foot creosote bush (Covillea) overtopping all the rest; for the range stands well within the arid area of the "Great American Desert," as Frémont properly named the region nearly a century ago, and the desert is still present in spite of its having been, in the flattering phrase of its venturesome settlers, "taken off the map." It is indeed a formidable feature of the Southwest to those who happen to be lost upon it, although invitingly entertaining to those who can dominate its dangers in this modern era of automobile travel.

From the higher, western end of the lava cap, we could see most of its extent gently slanting eastward before us; but instead of holding the same slant to the foot of the range, after the fashion of the evenly inclined Louderbacks of the Humboldt Lake ranges, the continuation of this lava sheet was upwarped or upfaulted in a series of separate, more or less convex and moderately inclined swells, between which a number of valleys were sharply incised. Not until it approached the eastern side of the range, was it lost to view on pitching down at a decidedly steeper slope. To the south several granite mounts rose with craggy and bouldery forms of moderate acclivity above the height at which the prolongation of the local lava cap would reach their flanks, as if they had held their heads up on the Powell surface like islands in the shallow lava sea, just as Steptoe Butte, southwest of Spokane, has stood up above the much heavier lava floods of Washington. The much higher mid-length of the Argus Range may also never have been lava covered, for it shows no trace of lava caps to-day.

This range may therefore be taken as a new type of fault-block mountain on three counts. First, in that its southern Louderback was exceptionally thin and markedly discontinuous; second, in that its uplift, near the southern end at least, was characterized by irregular upfaulting and upwarping; and third, in that the northern end of its fault face shows several close-set step faults. The exceptional thinness of the southern Louderback was noted on my first sight of it. None of its well-exposed edges, where numerous ravines are cut through it, appeared to have a greater thickness than 20 feet,[19] and as the part of the Powell surface that it covered appears to have included an area of several score square miles, that surface must have been very nearly a level plain before it was irregularly upheaved to its present attitude. It must have in that respect rivalled the Powell surface of the Humboldt Lake region, which is described by Louderback as being "of very low relief, approaching, to say the least, a peneplain," and as having "at many places closely approximated a plain." Residual mounts may, however, have survived there as well as in the Argus region; for an outflowing lava sheet would necessarily spread upon the lowest and flattest ground it could reach.

It may have been noticed that the foregoing pages treat different parts of the longer Basin ranges as if they were individuals; for nothing is clearer than that the upfaulting of the Gilbert blocks frequently varied in measure and in date along their length. This is manifest in the long Wasatch Range of Utah, where one can distinguish major, minor and minim faulting movements diversely developed at different points, as well as major, minor and minim detrital fans that have been formed in consequence of such movements. Several major fans are to be seen, hardly disturbed, near the town of Nephi, 75 miles south of Salt Lake City; minor fans abound farther north where minor movements have taken place; and minim fans may be seen some 40 miles north of Salt Lake City, where extremely recent movements have not only raised the mountains but have at the same time depressed the previously formed larger fans, so that the marshes of Great Salt Lake come almost immediately to the base of the range.

Another physiographic feature that gives some

[19] Since writing this statement, Mr. G. W. Richards, Jr., one of my students at Stanford University three years ago, has shown me several photographs of the Argus Louderbacks he has lately taken, in which a local thickening of the lava sheet to two or three times its ordinary measure appears at several points, as if the Powell surface were there rather strongly channeled.

variety to Basin Ranges is the occurrence of landslides on their fault fronts, as Russell years ago showed for some of the youngest ranges in the northwestern part of the Basin and Range province.[20] A large slide stretches several miles along and forward from the front of the Canyon Range, 70 miles southwest of Salt Lake City; but it is, like the range itself, so well dissected that little idea of its initial form can be gained; it is indeed of pre-Bonneville date, as bluffs of the Bonneville shore-line are cut along its outer margin. Its scar in the mountain front is completely effaced.[21] What I have taken to be a much younger slide in the northern part of the Wasatch Range, 70 miles north of Salt Lake City, has left a manifest cavity in the range front and has heaved up the piedmont alluvium in broad swells, little dissected.

It may well be that there is so great a physiographic variety displayed by the Basin Ranges that every one must be regarded as showing individual features. Hence when all the ranges have been professionally studied and made known in published reports the above-presented beginning of a collection to illustrate their variations, which might even now be enlarged by fuller reference to studies by other observers, may be extended to a comprehensive completeness. I wish some younger physiographic geologist, preferably one living in or near the Basin and Range province, might make the extension of the collection his specialty.

OPENING OF THE CANADIAN NATIONAL RESEARCH LABORATORIES

SCIENCE offers the greatest of all adventures. Science has no night, the dawn is always here. The scientific leaders of each generation open before the eyes of the world new avenues of activity, new sources of human enjoyment, new powers to be utilized in human development. May I say to the Government of Canada and to the people of Canada that we of the National Research Council are grateful for the opportunity that these laboratories will give us to take our share in the future development of our country, and will you believe me when I add that we shall regard these laboratories as a sacred trust given to us to be utilized for the upbuilding and strengthening of the nation.—*Dr. H. M. Tory, president of the National Research Council of Canada,* upon the occasion of the formal opening of Canada's National Research Laboratories.

IN the presence of more than 2,000 invited guests of the Honorable H. H. Stevens, the chairman of the Committee of the Privy Council of Canada on Scientific and Industrial Research, including the Right Honorable Stanley Baldwin, head of the Department of Scientific and Industrial Research of Great Britain, and the leaders of other delegations to the Imperial Economic Conference then in session in Ottawa, the Earl of Bessborough, Governor-General of Canada, formally declared Canada's new national research building open on Wednesday evening, August 10.

Dean J. W. Barker, of Columbia University, represented the National Research Council of the United States and the Bureau of Standards of the United States Department of Commerce. The official ceremony took place in the engineering laboratory, which, with the addition of the assembly hall, to which the addresses were carried by loud speaker attachments, provided ample accommodation. Arrangements were made for the transmission of the addresses by radio throughout the British Empire and the United States.

The Honorable Mr. Stevens, as chairman; the Right Honorable R. B. Bennett, the prime minister; His Excellency the Governor-General, and Dr. Tory, who, as president of the National Research Council of Canada, has directed its development since 1923, delivered addresses.

Following the official ceremony of opening, a reception in honor of Imperial Economic Conference visitors was held in the building, and guests inspected the exhibits prepared to illustrate the work of the four divisions into which the work of the laboratories has been divided: Biology and agriculture, directed by Dr. Robert Newton; chemistry, directed by Dr. G. S. Whitby; physics and engineering, directed by Dr. R. W. Boyle and J. H. Parkin, assistant director, and the division of research information, directed by F. E. Lathe.

The National Research Council of Canada was organized by the Government of Canada during the world war and proceeded to its work along three main lines until 1928, when the organization of National Research Laboratories at Ottawa was commenced: (1) The granting of scholarships to train research personnel; (2) the granting of assistance to individuals in university or other laboratories to make particular researches possible; (3) the coordination and stimulation of group research efforts.

In what is now known as the National Research Laboratories Annex, the division of physics and engineering and the division of chemistry commenced operations in 1929, and construction of aeronautical

[20] I. C. Russell, "Topographical Features Due to Landslides." *Pop. Sci. Monthly,* 4, 1898, 480–489.

[21] See the above-cited article on the Wasatch, Canyon and House ranges.

laboratories, consisting of wind tunnel, water test tank and engine-testing facilities, was begun. Development of the division of biology and agriculture, pending the completion of the new building, construction of which was commenced in 1930, was centered at the University of Alberta. At approximately the same time the division of research information was organized to conduct the National Research Library, now housed in the new National Research Laboratories Building, the *Canadian Journal of Research*, a monthly publication of the council, and related services.

The main building now formally in service is constructed on a flat site of ten acres at the junction of the Rideau and Ottawa Rivers and looks out, in the distance, to the valley of the beautiful Gatineau, another tributary of the Ottawa. It is four stories high, contains approximately four million cubic feet of space, is severely classic in style and built of Canadian sandstone brought from the Wallace Quarries of Nova Scotia. The plan is rectangular, enclosing two large open interior courtyards which give ample light to all laboratory rooms overlooking them. The construction contract totalled approximately $3,000,000.

In declaring the new building open, the Earl of Bessborough paid tribute to Canadian scientific accomplishments in the following terms:

> Not only does the past history of Canada record the development of educational institutions in the ordinary sense, and the application of science to practical problems, it also shows a zeal on the part of Canadian intellectual leaders to have their country share in the scientific progress of the world. The foundation of the Royal Society fifty years ago, and the growth of the many affiliated societies aiming at the development of natural knowledge, is evidence of the truth of this statement. One has but to recall the contributions to science of men like Logan and Dawson in geology, Sterry Hunt in chemistry, Osler in medicine and a score of others that might be named of the generation that has passed, to realize how much was accomplished, even in pioneering days. The tradition established by such men has been followed by a group of scientific workers of this generation in almost every field of science. Amongst these it is perhaps invidious to make distinctions, but one has only to recall such names as Miller and Adams in geology; Macallum, Banting and Collip in biochemistry; Callender and McLennan in physics; Saunders and his coworkers in agriculture, to realize that this generation has determined to hand on the torch undimmed to those who are to follow.

The Earl of Bessborough stated in opening his remarks:

> I conceive the erection of this home for scientific and industrial research to be an indication that Canada has resolved to take her place among the nations who believe that progress must rest upon knowledge, that vast resources are valuable in proportion as they are intelligently and scientifically used.

Referring to the practical accomplishments of the National Research Council, Dr. Tory spoke in part as follows:

> The Research Council of Canada can show as a result of its years of activity practical results of a far-reaching character. May I be permitted, Mr. Chairman, to say to you and His Excellency in the presence of this distinguished assembly, that, viewed from the point of view of practical results expressed in monetary returns to the nation, the Research Council has already repaid not only the cost of its current expenses, but the total cost of this building. May I be forgiven if I give one or two illustrations. One piece of research completed approximately ten years ago was estimated at that time by the fishing industry to have an annual value of $500,000. Giving it a value of only half the amount then estimated, that alone over a period of ten years is a substantial offset to the cost of the Research Council's activities. On the basis of another practical piece of scientific work an important new industry has been built in Canada, which has turned a hitherto waste material of enormous dimensions into a product which is now entering the markets of the world, being sold not only in Canada, but in the United States and Great Britain as well. The annual output of this industry to-day is at least a million dollars. The scientific results obtained in the crowded laboratories of the National Research Council have given it a value that has world-wide significance. If time permitted I might also mention to you a group of other researches of equal significance to the above, some of them completed, some in course of completion in connection with the agricultural development of our country.

A beautiful ceremony associated with the official opening occurred on the following day when, on behalf of Surgeon-Captain R. J. E. Hanson, of Fowey, England, Mr. Baldwin presented a number of paintings and photographs of distinguished men of science, including a small painting of Faraday, once the property of Sir William Crookes, which bears a statement by the late King Edward VII, who knew Faraday, that the painting is a very good likeness. Mr. Baldwin said in his address that science knew no bounds of religion or race:

> It is universal. And if there is one study more than any other for which the right spirit is reverence and humility that is it. And I will tell you why. Reverence, because your work lies all the time in the region of the profound mysteries of the universe. For even when the so-called discoveries are made they remain mysteries and will, so far as the human brain can penetrate.

And humility, because the greater the man the more he realizes how limited is the sphere in which he can work in the vastness of infinity. And he knows that, great as his genius may be, it would be nothing but for the work of those who have gone before him. The greatest man in science to-day is dependent upon the work of his predecessors. The search for truth is eternal and will last as long as the world. It was Sir Isaac Newton who declared: "If I have seen farther, it has been by standing on the shoulders of giants."

And there is one other thing about science and scientists. They are men who serve their generation in as great a measure as any, but you never heard of the scientific genius who became a millionaire by gain. That is one of their glories.

It is not the calling of every man to pursue science or research. But may it be your fortune to find here the man who is born for research, that something may be accomplished in this building, or may be discovered, which will run round the world and make his name famous. He will not then want material rewards. They can come to the exploiters. But long after we have mouldered into dust the name of such a man, as of those attached to these pictures, will be handed down from generation to generation as among the benefactors of mankind.

OBITUARY

JOHN ISAAC BRIQUET

BOTANICAL science has suffered a grievous loss in the death of Dr. John Isaac Briquet, late director of the Conservatoire Botanique of Geneva, who passed away on October 26, 1931, after a brief illness.

Briquet was born in Geneva in 1870, studied botany under Schwendener, Engler, Thury, Jean Müller and Alphonse de Candolle, and attained the doctorate in 1891. For the remainder of his life he was connected with the Conservatoire Botanique, first as assistant director and later as director. During his administration several of the large herbaria of Geneva were consolidated and housed in the convenient building of the Conservatoire, together with an excellent library. Remarkably rich in valuable historical material, the collection at once took a place among the leading herbaria of the world.

His first extensive research was in the taxonomy of the genus *Galeopsis;* this led to an interest in the family Labiatae which continued to his death. His taxonomic work naturally took him into many diverse fields and resulted in a long list of publications. He was keenly interested in the flora of the southern Alps, contributing largely to Burnat's "Flore des Alpes Maritimes," and in cooperation with Cavillier continuing this important work after the death of the founder. Perhaps his most important floristic work is his "Prodrome de la Flore Corse." The breadth of his botanical knowledge is shown by numerous papers in various other fields of botany, including such diverse subjects as comparative anatomy and statistical methods. A list of his published works will include about four hundred titles.

Briquet early became interested in the difficult problems of botanical nomenclature. At the international congress in Paris in 1900 he was appointed *rapporteur* of the nomenclature commission and continued in this position until his death. He was personally largely responsible for the international code adopted at Vienna in 1905 and revised at Brussels in 1910. When the questions of nomenclature were revived after the war, he attended the congress at Ithaca in 1926 and after it assumed the chief responsibility of the difficult preparation for the Cambridge congress of 1930, at which rules acceptable apparently to a large majority of botanists were adopted. Not only was his preliminary work of great value, but in the congress itself he was a power in directing and leading the thought and action of the delegates. Always cool and clear-headed, never confused by difficult questions, always understanding and in command of the situation, he did as much as or more than any other person to bring the nomenclatural discussion to a successful conclusion.

During his lifetime Briquet was the recipient of numerous honors. His doctorate thesis received the prize of the Academy of Sciences in Brussels. He was president of the Institut National Genèvois, of the Société de Physique et Sciences Naturelles de Genève and of the Société Botanique de Suisse; France admitted him to the Légion d'Honneur, and Cambridge conferred on him the doctorate *honoris causa*.

By the numerous Americans who have worked at his Conservatoire, his death is felt with especial sadness. Speaking English fluently, naturally genial in disposition, delighting to introduce visitors to the hospitality of his home, he invariably made their visit to Geneva pleasant as well as profiable.

H. A. GLEASON

NEW YORK BOTANICAL GARDEN

RECENT DEATHS

DR. GEORGE I. ADAMS, head of the department of geology in the University of Alabama, died on September 8 at the age of sixty-one years.

FRANCIS LA FLESCHE, ethnologist, son of the last chief of the Omaha Indian tribe, died on September 5

at the age of seventy-five years. Mr. La Flesche worked for thirty years in the Bureau of Indian Affairs. In 1910 he became associated with the Smithsonian Institution.

M. W. ALEXANDER, engineer, president of the National Industrial Conference, died on September 10, at the age of sixty-two years.

PROFESSOR KYOJI SUYEHIRO, director of the Earthquake Research Institute, Japan, died on April 9, at the age of fifty-five years.

SCIENTIFIC EVENTS

A BRITISH LABORATORY FOR FRESH WATER BIOLOGICAL RESEARCH

IN Great Britain, according to *Nature*, research on fresh water biological problems has, for many years, suffered from the lack of adequate laboratory facilities—a curious fact since so much valuable pioneer work has been done in the British Isles, particularly on the lakes. The opening of a laboratory under the control of the Fresh Water Biological Association of the British Empire has removed this drawback, and investigators wishing to pursue the various branches of fresh water research can now be assured of obtaining the requisite facilities.

The article in *Nature* reports that the laboratory is situated in Wray Castle, about three miles from Ambleside, on the north-west shore of Windermere. The lake reaches its maximum depth, just over seventy meters, about a quarter of a mile from the boathouse, and different types of inflowing streams and of shore lines are within a convenient distance. There is also a large number of streams and of smaller bodies of standing water within a short distance of the laboratory, these including examples of very diverse types, while almost the whole range of British fresh water habitats can be found within a distance of fifteen miles. There is thus abundant scope for biologists interested in plants or animals of special groups or in their habitat conditions.

The laboratory is equipped for most of the usual types of biological research. It contains ample facilities for microscopical and for experimental work, both purely physiological and also chemical. Gas for heating purposes is provided from a petrol-air installation. There is a large range of basement cellars which are used for aquaria or for storage purposes, while dark rooms are also available. The usual equipment for plankton investigation is provided, and for this and other forms of lake work a motor launch is available, as well as a smaller boat. This launch is a twenty-four-foot sea-going pinnace, fitted with gears so that very low speeds can be maintained for dredging operations. It also has a derrick and a winch driven by the motor for lifting heavy apparatus. The launch is provided with electric light and navigation lights for night work.

Persons working in the laboratory can obtain a variety of accommodation in Ambleside, and simple accommodation is available in the castle itself, rooms having now been fitted up for this purpose. Inquiries about working places and research facilities may be made to the naturalist-in-charge, Wray Castle, Ambleside, Westmoreland, or to the honorary director, Dr. W. H. Pearsall, The University, Leeds.

A WILD LIFE STATION IN THE ADIRONDACKS

THE largest gift of forest land to an educational institution in New York State has been made by Archer Milton Huntington and Mrs. Huntington, of New York City, to The New York State College of Forestry at Syracuse. The forest will be known as "The Archer and Anna Huntington Wild Life Forest Station." Mrs. Huntington is the daughter of the distinguished biologist, the late Alpheus Hyatt.

The area embraces fourteen parcels of Adirondack forest land and lakes, aggregating more than 13,000 acres, located principally in Essex County in Townships 27 and 28 and partially in the Town of Newcomb. The forest is accessible from the Newcomb-Long Lake highway near Rich Lake.

The land will be used for experiment and research in relation to the habits, life histories, method of propagation and management of fish, birds, game food and fur-bearing animals by the Roosevelt Wild Life Station at the College of Forestry and also by the college directly in the promotion of forestry as an aid to game management.

In commenting on the gift Chancellor Charles W. Flint said:

> No finer tract of land for a wild life preserve could be found in New York State. The New York State College of Forestry is certainly to be congratulated on this responsibility and opportunity to develop an important phase of forestry work to which it is dedicated in its charter.
>
> It is a magnificent as well as a munificent gift on the part of Mr. and Mrs. Huntington, both of whom have long evinced an interest in wild life; indeed, that is the field in which Anna Hyatt Huntington did her earliest work as a sculptor and which includes some of her most noted work.
>
> Under the careful supervision and management of the College of Forestry I believe this will become one of the

most valuable assets of the state in the field of wild life investigations and management, bringing to the college and the state national significance and reputation.

Dean Hugh P. Baker said:

This splendid gift of a great area of wild forest land by Mr. and Mrs. Archer M. Huntington, of New York City, provides the opportunity for investigation and research in the field of wild life management for which the State College of Forestry has been looking throughout the period of its twenty years of activity in the wild life field. The Archer and Anna Huntington Wild Life Station, as the property is designated by the donors, is unexcelled by any other similar area in the state for the work for which it is designated. It is in fact the Adirondack Park in miniature in that it contains two large and numerous small lakes with streams, and above these marsh land, wooded slopes and two mountains of over 2,500 feet in height. It is exceedingly rich in the flora and fauna of the Eastern Adirondacks. Under the direction of the college and through the Roosevelt Wild Life Forest Experiment Station it should be possible to take this miniature of the Adirondacks as a whole and make it gradually a reservoir of information as to the most scientific and most practical means of making our forest areas give the maximum of usefulness. In carrying out the purposes of the donors it should be possible to demonstrate that both the wild life and the forest in all of its phases can be kept in balance, producing increasing values in the way of wild life, recreation and direct forest products.

The forest will remain a sanctuary for wild animal life. No shooting of game or fishing will be permitted except in the furtherance of the conservation purposes to which Mr. and Mrs. Huntington have dedicated the property.

The Roosevelt Wild Life Station, which will use the Huntington gift as a field station, is conducted as a department of the State College of Forestry. It was established in May, 1919, by the New York State Legislature as a memorial to Theodore Roosevelt.

The Advisory Council is composed of the following conservationists: The Honorable Theodore Roosevelt, Mrs. Corrine Roosevelt Robinson, Mr. Kermit Roosevelt, Dr. George Bird Grinnell, Mr. Chauncey J. Hamlin, the Honorable Gifford Pinchot, Dr. George Shiras, 3d, Dr. Frank H. Chapman, Dean Henry S. Graves, Viscount Grey (European member).

NEW COLLECTIONS OF THE FIELD MUSEUM, CHICAGO

THE Field Museum has received from the Botanical Garden and Museum of Berlin several boxes containing material forwarded by Assistant Curator J. Francis Macbride, who has been engaged for three years in obtaining, with the aid of a grant from the Rockefeller Foundation, photographs of historical plant specimens preserved in the large herbaria of Europe.

The present shipment includes 4,000 negatives of plants of the Berlin Herbarium, the total number of such negatives now exceeding 20,000. These represent as many species of plants, chiefly South American, and comprise one of the most practically useful collections for the study of the South American flora that ever has been brought together. When prints from all the photographs have been inserted in the Field Museum Herbarium, it is said that it will afford facilities for studying the plants of South America such as are possessed by scarcely any other American institution. Duplicates of these prints are made available to other botanical institutions at a nominal price.

In addition, there were returned by Mr. Macbride more than 2,000 sheets of Peruvian plants, mainly those collected by the several Marshall Field Expeditions. These have been studied and named at Berlin, and compared with authentic specimens, thus affording standards for future study of Peruvian plants.

Mr. Macbride is now engaged in further study and photographing at the Botanical Museum of Munich, which owns the largest series of Brazilian plants collected and studied by Martius, explorer and author of the "Flora of Brazil."

Recently the Field Museum returned 800 sheets of tropical American plants that had been received for determination from the University Botanical Museum of Copenhagen, through its director, Dr. Carl Christensen, fern specialist. The sending consisted chiefly of South American plants of the Rubiaceae or coffee family, which were studied and named by Associate Curator Paul C. Standley, largely by comparison with authentic specimens in the museum herbarium. There were many specimens collected a hundred years ago by Lund and Warming, who worked in Brazil, and numerous collections made along the Amazon about 1850–60 by Richard Spruce.

The loan received from Copenhagen included also a large number of legumes obtained in Mexico seventy-five years ago by Liebmann. Many of the plants he discovered never have been found by later botanists.

The Copenhagen museum has generously presented to the Field Museum a substantial number of duplicates.

THE DEVELOPMENT OF MEDICAL SCHOOLS

THE *Journal* of the American Medical Association reports the following advances in the work of medical schools:

University of California Medical School: Plans are being prepared for the construction of a new building

which will house the activities of the outpatient department of the University of California Hospital. The Christine Breon Fund became available for medical research in the medical school and the Lillie Spreckles Wegeforth Fund for research on respiratory infections.

Yale University School of Medicine Buildings Completed: The Sarah Way Tompkins Memorial Pavilion of the New Haven Hospital, providing modern ward facilities for surgical cases, opened early in June, 1932.

George Washington University School of Medicine: During the past year a new four-story laboratory building, adjoining the medical school, has been constructed. The old medical building is being completely remodeled and all laboratories are being newly equipped for teaching and investigative work.

University of Minnesota Medical School: A new medical science building has been erected to be used primarily for dentistry but also for some medical classes.

St. Louis University School of Medicine: During the session 1931–1932, progress has been made toward the completion of a new unit of the University Hospital, the Firmin Desloge Hospital. The program for developing graduate fellowships has been enlarged, so that during 1931–1932 nine new appointments and six reappointments have been made.

University of Nebraska College of Medicine: A reserve fund of $1,500 for special research was received and an endowment for the department of pediatrics from the estate of Dr. H. M. McClanahan, formerly chairman of the department, the present valuation of which is $30,000.

Albany Medical College: Four fellowships have been established, three through the Littauer Foundation and the other through the Schepp Foundation. An appropriation was received from the Rockefeller Foundation for activities of the Regional Extension Department and from the General Electric Company for special research and other purposes.

Columbia University College of Physicians and Surgeons: The Institute of Ophthalmology of the Presbyterian Hospital is now in process of construction, with a capacity of 110 beds.

University and Bellevue Hospital Medical College: Gifts amounting to $205,779, principally for research, have been received.

Duke University School of Medicine: The Nurses' Home was completed in June, 1932.

University of Oregon Medical School: An appropriation for research from the Rockefeller Foundation of $13,000 was received, to cover a two-year period.

Jefferson Medical College of Philadelphia: The Curtis Clinic Building, containing all the outpatient departments, was opened.

Meharry Medical College: The new plant, including medical school, hospital and nurses' home, was completed in September, 1931, and the session of 1931–1932 opened in the new buildings, with new equipment.

Vanderbilt University School of Medicine: An appropriation of $250,000 was made by the Rockefeller Foundation for research over a period of eight years; an appropriation of $50,000 was made by the General Education Board for the purchase of books and periodicals by the medical library to be distributed over a period of four years.

University of Texas School of Medicine: The dedication of the John Sealy Hospital Outpatient Department, the Medical Laboratory Building and the Rebecca Sealy Residence for Nurses occurred in May.

Marquette University School of Medicine: A new medical building, erected at a cost of $500,000, is ready for occupancy and all activities and classes of the medical school will be resumed in the new building for the session 1932–1933.

McGill University Faculty of Medicine: A gift of $1,232,652 was received from the Rockefeller Foundation for the endowment of a Neurological Institute.

Laval University Faculty of Medicine: A new amphitheater, new equipment and a new museum have been provided for the department of anatomy. New buildings have been erected for the Institut de Biologie and Institut du Cancer at Quebec.

PLANT PATHOLOGY AT THE ROCKEFELLER INSTITUTE FOR MEDICAL RESEARCH, PRINCETON, NEW JERSEY

THE Division of Plant Pathology of the Rockefeller Institute will be in operation by October 1, 1932. Ground was broken on November 9, 1931, and the buildings designed to house the division consist of a laboratory 144 by 40 feet, two and one half stories in height, eight greenhouses, each 65 feet in length, and a potting shed. The new division adjoins the Division of Animal Pathology. The name of the laboratories and accessory buildings has been changed to the Department of Animal and Plant Pathology. Dr. Carl TenBroeck, successor to Dr. Theobald Smith, is director of the department and head of the Division of Animal Pathology. Dr. Louis O. Kunkel, formerly pathologist at the Boyce Thompson Institute of Plant Pathology at Yonkers, New York, is head of the Division of Plant Pathology. Dr. Kunkel studied and received degrees at the University of Missouri; Washington University, St. Louis, and Columbia University, New York. He was associated also with the United States Department of Agriculture and the Hawaiian Sugar Plantation. He has been engaged in the investigation of virus diseases of economic and ornamental plants, including tobacco, sugar cane, corn and asters. He is a member of the National Academy of Sciences. Associated with Dr. Kunkel will be Dr. Francis O. Holmes, protozoologist, recently with the Boyce Thompson Institute; Dr. Herbert T. Osborn, entomologist; Dr. Wendell M. Stanley, chemist, and several fellows.

SCIENTIFIC NOTES AND NEWS

THE Executive Committee of the American Association for the Advaucement of Science will hold its regular fall meeting at the Hotel Haddon Hall, in Atlantic City, on the third Saturday and Sunday in October, which fall on the fifteenth and sixteenth of the month. There will be two forenoon and two afternoon sessions. Business to come before the committee at this meeting should be in the permanent secretary's office in Washington by October 1.

SIR FREDERICK GOWLAND HOPKINS, professor of biochemistry at the University of Cambridge and president of the Royal Society, has been nominated as president of the British Association for the Advancement of Science for the meeting to be held next year at Leicester.

DR. FRANK SCHLESINGER, director of the Yale University Observatory, was elected on September 9 president of the International Astronomical Union at the final assembly of the fourth triennial meeting of the union, held at Cambridge. He succeeds Sir Frank Dyson, Astronomer Royal of England. Two new vice-presidents were also elected. They are Professor T. Banachiewicz, of Poland, and Professor E. Bianchi, of Italy, replacing Professors G. Abetti, of Italy, and C. Fabry, of France. It was voted to convene the next meeting of the union in 1935 in Paris.

DR. L. L. THURSTONE, professor of psychology at the University of Chicago, was elected president of the American Psychological Association at the recent meeting at Ithaca. New members of the council elected were Dr. E. A. Bott, professor of psychology at the University of Toronto, and Dr. Henry E. Garrett, assistant professor of psychology at Columbia University. Dr. Thurstone succeeds Dr. Walter R. Miles, professor of psychology at Yale University, whose presidential address was on "Age and Human Ability." There were about 500 members and associates of the association in attendance at the meeting.

DR. FREDERICK G. KEYES, professor of physical chemistry at the Massachusetts Institute of Technology and a reserve officer in the Chemical Warfare Service, was the recipient on September 9 of the military decoration of the Purple Heart. Presentation of the medal was made at a dinner at the Harvard Faculty Club attended by twenty reserve officers of the Chemical Warfare Service. Lieutenant Colonel Keyes was awarded the decoration, according to the citation from the Secretary of War, "for services as director, Chemical Warfare Service Experimental Laboratory at Puteaux, A.E.F., while serving as major."

THE *British Medical Journal* reports that Major D. T. Richardson, M.C., Royal Army Medical Corps, has been awarded the Leishman Prize (Officers) for the year 1931, consisting of a silver medal and a sum of £30, for his work in the interests of military hygiene. The Leishman prize is awarded annually for the best piece of work in any branch of medicine, surgery or allied science, or in connection with the general duties of the Royal Army Medical Corps, by an officer of the Royal Army Medical Corps, or Army Dental Corps, or by an officer removed from either of these corps but still on the active list.

RETIREMENTS from the staff of the Smithsonian Institution under the economy bill include W. H. Holmes, director of the National Gallery of Art; W. deC. Ravenel, director of arts and industries and of the division of history; B. A. Bean, assistant curator of the division of fishes; Richard A. Allen, scientific aid in the department of anthropology, and De Lancey Gill, illustrator. R. P. Tolman has been appointed acting director of the National Gallery of Art; J. E. Graf is director of arts and industries and the division of history, and Leonhard Stejneger, head curator of the department of biology, who is exempted from the retirement provision by executive order, takes direct charge of the division of fishes.

DR. CYRIL N. H. LONG, assistant professor of medical research in the McGill University Faculty of Medicine, has been appointed director of the George S. Cox Medical Institute for research in diabetes at the University of Pennsylvania Hospital. Dr. Long, who has been engaged in investigations of diabetes and diseases of metabolism at McGill and at University College, London, for the past eight years, will also serve as assistant professor of medicine. The Cox Institute was opened on March 18, under the temporary direction of Dr. J. Harold Austin, John H. Musser professor of research medicine in the school of medicine.

DR. EDWARD QUIN THORNTON, associate professor of materia medica at Jefferson Medical College, Philadelphia, has been appointed Sutherland M. Prevost professor of therapeutics, to succeed the late Dr. Elmer H. Funk.

W. J. GERTSCH has been appointed assistant curator, in charge of spiders, at the American Museum of Natural History.

PROFESSOR LOUIS DE BROGLIE, of the University of Paris, has been assigned to the professorship of theoretical physics to succeed M. Brillouin.

M. ESCLANGON, director of the Observatory of Paris, has been elected an honorary member of the Bureau of Longitudes, to succeed the late M. Bigourdan.

MR. HENRY C. HENRICKSEN, for many years on the staff of the Federal Agricultural Experiment Station in Puerto Rico, was retired from the service at the beginning of this fiscal year. His work was not interrupted, however, as the Fruit Growers Research Laboratory, sponsored by the Fruit Growers of Puerto Rico, was established immediately. The Federal Government has agreed to let Mr. Henricksen continue his work in the laboratory he has been occupying for many years and the Insular Government has offered to share the expenses connected with the work.

DR. T. G. YUNCKER, professor of botany at DePauw University, has arrived in Honolulu. As a Yale-Bishop Museum fellow, he will make a study of the Hawaiian Peperomias. Professor Yuncker's headquarters will be at the Bernice P. Bishop Museum.

DR. W. E. VAUGHAN, instructor in chemistry at the University of Chicago, has obtained a renewal of his National Research Fellowship and will spend this year at the California Institute of Technology working on problems in thermal reaction rates under the supervision of Professor Tolman.

PROFESSOR T. C. POULTER, head of the department of physics at the Iowa Wesleyan College, will be the physicist on the staff of Admiral Byrd on his next trip to the South Pole.

DR. L. O. HOWARD, chief entomologist in the U. S. Department of Agriculture from 1894 to 1927 and permanent secretary of the American Association for the Advancement of Science from 1898 to 1919, returns to the United States about October 1. He has been in Europe for somewhat more than a year, spending most of the time in Paris. His return to the United States is occasioned in part by the need of an operation on his eyes.

DURING the latter part of August Dr. Henry Fairfield Osborn, president of the American Museum of Natural History, New York, and Walter Granger, curator of fossil mammals, joined Barnum Brown, curator of fossil reptiles, in paleontological excavations in Montana, after which they expected to engage in further operations in Nebraska and Colorado.

DR. H. K. HAYES, professor and chief of the division of agronomy and plant genetics of the Department of Agriculture of the University of Minnesota, has been granted leave of absence for the academic year 1932–33 and has been appointed acting professor of plant breeding at Cornell University. Dr. Hayes will fill the position left vacant temporarily by Dr. H. H. Love, who has charge of a plant breeding project for the Chinese government.

PROFESSOR C. L. A. SCHMIDT, chairman of the department of biochemistry of the University of California, left in May to attend the International Physiological Congress in Rome and to study biochemistry teaching methods under the sponsorship of the Oberlaender Trust of Philadelphia. Among the groups before which he spoke were: The Chemical Society of Würzburg on the occasion of its seventy-fifth anniversary; the departments of chemistry, biochemistry and physiology and the administrative officers of the University of Leipzig. He also gave a lecture before the biochemical, physiological and medical groups of Frankfurt am Main.

HUGH RUTTLEDGE, retired from the Indian Civil Service, will lead a Royal Geographical Society expedition next year in an attempt to scale Mount Everest. J. M. Scott, who was a member of the British expedition searching for a suitable air route over the Arctic, has been appointed secretary of the expedition.

Nature gives the following list of foreign visitors to the British Association for the York meeting who attended in an official capacity either as guests or as representatives of foreign associations: *Section A* (Mathematics and Physics): Dr. W. Meissner, Physikalisch-technische Reichsanstalt, Berlin-Charlottenburg; M. le Duc de Broglie, Paris; Professor W. J. de Haas, University of Leyden, Holland. *Section B* (Chemistry): Professor J. Meisenheimer, Chemical Institute, Tübingen; Professor H. Staudinger, University of Freiburg im Breisgau; Professor Max Bergmann, Technical High School, Dresden; Professor H. Kessener, The Hague. *Section C* (Geology): Professor P. Pruvost, University of Lille. *Section E* (Geography): Dr. J. Georgi, Hamburg. *Section H* (Anthropology): Dr. Axel Boethius, director of the Swedish School of Archeology, Rome. *Section J* (Psychology): Professor R. H. Wheeler, University of Kansas, United States. *Section K* (Botany): Dr. G. E. du Rietz, University of Uppsala, Sweden. Professor Oswald Veblen, of Princeton University, attended as the delegate of the American Association for the Advancement of Science, while Professor D. A. Keys represented the Royal Society of Canada. The South African Association for the Advancement of Science was represented by Professor J. E. Duerden.

Museum News reports that the survey of the museums of the British Empire financed by the Carnegie Corporation of New York and undertaken by the Museums Association (British) has been about two thirds completed. Territory already covered includes Canada, South Africa and the British possessions in the Mediterranean (Malta, Cyprus and Gibraltar).

The report on the Canadian survey, with accompanying directory, has already been submitted to the Carnegie Corporation. To complete the survey there remains Australia, Tasmania, New Zealand, the West Indies, and outlying possessions. The Canadian and South African surveys were made by Sir Henry A. Miers and S. F. Markham; the Mediterranean, by Charles Squire and D. W. Herdman. The Museums Association plans to publish a directory of museums in the dominions. This, with the directory of museums in the British Isles, published last year, will form a directory of the Museums of the British Empire.

THE first International Congress of Mediterranean Hygiene will he held at Marseilles on September 20, under the auspices of the medical faculty of that town, and under the patronage of the President of the Republic. The conference, which lasts for five days, will include discussions upon undulant fever, dengue, the de-ratization of ships, *spirochétose espagnole* and *fièvre exanthématique méditerranéenne*. An excursion to Provence has been arranged for September 25. Special terms are offered in respect of boat and railway fares and accommodation. The president of the congress is Professor E. Marchoux. For further information applicants are invited to communicate with Professor H. Violle (general secretary), Faculté de Médecine, Palais du Pharo, Marseille.

A WESTERN States Regional Outlook Conference was held at Salt Lake City, on August 11 and 12, under the auspices of the Bureau of Agricultural Economics. Representatives who attended were Dr. O. C. Stine, in charge of the division of statistical and historical research; C. A. Burmeister, livestock, meat and wool division; H. M. Dixon, in charge of the economics extension unit, and Frank Andrews, statistician for Utah. The bureau economists explained, by use of charts, the factors affecting economic developments in agriculture in the last decade, and the information thus presented was used as background for the commodity discussions—on dairying, wheat, beef cattle and sheep. After these studies and explanations of charts the economists asked the extension men to say what kind of advice they would give farmers under certain conditions. About fifty people attended the meeting, including extension and research workers of the various state colleges of agriculture in the region.

THE Royal Research Ship, *Discovery II*, operating under the direction of the Falkland Islands government and carrying a crew and five British investigators, has sailed into the Antarctic to estimate the whale population of this region, according to a report from the American Consulate at Melbourne, Australia. The party will also gather data to serve as the basis for an international agreement to prevent overfishing and depletion of the whale herds. The vessel, which left London in October, 1931, has made two cruises. The first was from Cape Town, South Africa, to the fringe of the ice pack and then to Fremantle. The second was from Fremantle to the ice and then to Hobart, Tasmania and Melbourne. On the present trip, the vessel will go to New Zealand and from there it is expected that the northern waters of the Antarctic coast will be touched on the return to the Falkland Islands early in October this year.

DISCUSSION

LIGHT OR EXERCISE AS FACTORS IN SEXUAL PERIODICITY IN BIRDS?

IN an interesting review in *Nature*[1] of Professor Roman's book, "The Riddle of Migration," Professor MacBride accepts it as proven that increasing periods of wakefulness or of muscular exercise per day are the direct cause of the spring increase in the size and activity of the reproductive glands of juncos and, presumably, of other birds such as poultry, and not the increasing periods of exposure to light radiation as such. The acceptance and endorsement of this theory by a biologist of Professor MacBride's recognized standing may lead many to infer that the experiments supporting the statement of this theory were conclusive proof of the validity of the generalization to the exclusion of all other possible explanations of the results.

It seems worth while to inquire as to the conclusiveness of the experimental tests of the theory and the possibilities of other interpretations of the results of this single experiment, which is described by Professor Rowan himself in *Nature* in 1928,[2] so that the facts need not be recapitulated here. Taken alone, they appear to indicate that exercise caused the testes of birds, subjected to it, to increase in size, while those of birds not subjected to it did not do so. But the fact that increased exercise might be but a contributory factor, and not the major one operating, was not excluded.

Studies by Bissonnette[3, 4, 5] on starlings, in Hartford, Connecticut, in this connection, show that it is

[1] *Nature*, 129 (3259): 561–2, April 16, 1932.

[2] *Nature*, 122 (3062): 11–12, July 7, 1928.

[3] *Am. Jour. Anat.*, 45: 289–305, 1930. See p. 299.

[4] *Jour. Exp. Zool.*, 58: 281–319, 1931.

[5] *Physiol. Zool.*, 4: 542–574, 1931, and 5: 92–123, 1932.

the daily changes in radiation, as such, and not the changes in periods of muscular exercise, that modify the reproductive cycle and sex-glands of starlings.

Although Professor Rowan knew, from correspondence in the spring of 1929, the results of Bissonnette's experiments, he has taken no cognizance of them and has dismissed them as irrelevant to his subject—possibly because, in Hartford, starlings do not migrate. But their sex-glands do change in relation to exposure to light, just as do those of juncos in Edmonton, Alberta, as described by Professor Rowan. In his book he ignores these studies and fails to mention the possibility that the season of the year (March and April), in which he performed the experiments cited by Professor MacBride, and the previous activity of the sex-glands of his birds (already increasing in size and activity as the results of increasing daylight periods[2]), may have influenced his results, as well as his immediate experimental treatment. Bissonnette has already discussed this probability.[3, 4, 5, 6]

Bissonnette's studies[7] and those of Bissonnette and Wadlund,[7, 8] indicate that, in starlings, at least, testis size and activity are conditioned by daily period, intensity and wave-length of the light to which the birds are exposed; but that, with the several types of stimulating illumination used by them, testis regression invariably sets in after a variable period of complete sperm formation. This period is shorter in birds brought to the climax quickly, and longer in those more slowly activated. An optimum wave-length, somewhere in the red, and an optimum intensity of white light below 185.6 foot candles, and nearer 29 foot candles, are indicated. The type of food may be a limiting factor and prevent testis activation by such stimulating types of illumination, in some cases at least.

Bissonnette's analysis of the effects of increased daily periods of muscular exercise, both with and without changes in exposure to light, indicated that such increases of exercise prolonged the refractory period or led to a lag in the appearance in the testes of the activity-changes induced by changes of illumination, whether of increasing or of decreasing activity. With unchanged lighting conditions, increased exercise reduced the size of the testes, if those testes were in mid-winter quiescent condition. Acting on such quiescent testes, added exercise periods, given in the manner used by Professor Rowan, without added light periods, did not induce any increase of testis activity, but lessened it and caused the glands to become still smaller. If birds already undergoing activation by increasing illumination had their illumination reduced and their daily exercise periods increased, their sex-glands continued to increase in size for a longer period, before undergoing regression, than did those of birds with reduced light periods without added exercise (a reaction similar to that of Professor Rowan's birds). On the other hand, if birds were undergoing regression due to decreased light periods, those given added light and added exercise continued to regress longer, before beginning to increase in size and activity, than did those with added light but no additional forced exercise periods.[4] The conclusion was therefore drawn that, though increasing exercise periods were not themselves stimulating to sex-gland activity, they modified the response of the glands to the action of changing doses of visible radiations, which were potent to modify the sexual activity of these birds.

That these effects of changing conditions of illumination are not confined to birds, but occur in some mammals also, though in somewhat different manner and degree, is indicated by the studies of Baker and Ranson[9] on voles, and by Bissonnette[7, 10] on ferrets. The differences, so far noted, between the responses of birds and those of mammals to this experimental treatment have been discussed elsewhere.[10]

The work of Wang,[11] of Wang, Richter and Guttmacher,[12] and of Bugbee and Simond,[13] with albino rats, has shown that spontaneous activity, as measured by a recording device, varies with the oestrous cycle and is greatest at the time of heat; that this is not found in males nor in ovariectomized females, but can be induced in castrated males by ovarian grafts, and in ovariectomized females by properly spaced injections of proper amounts of extract of ovarian follicular hormone. These changes in activity are the result, not the cause, of sex-gland changes. They lend support to the suggestion that, in fowl, as cited by Professors Rowan and MacBride, the increased sexual activity induced by increased illumination causes increased food consumption and consequent increased exercise to get it; instead of the increased muscular activity causing the increased sexual activity and food consumption.

The studies cited above show that the power of increasing exercise periods to induce sex-gland activity is not completely demonstrated. On the contrary, increasing exercise is probably, at most, only a modifying factor related to the time and rate of response

[6] *Nature*, 129 (3260): 612, 1932.

[7] Aided by grants from the Committees for Research in Problems of Sex and for Grants-in-Aid, of the National Research Council of the U. S. A.

[8] *Jour. Morph.*, 52: 403–428, 1931.

[9] *Proc. Roy. Soc. B.*, 110: 313–322, 1932.

[10] *Proc. Roy. Soc. B.*, 110: 322–356, 1932.

[11] Comp. Psychol. Monographs, Series 2, No. 6, 1923.

[12] *Am. Jour. Physiol.*, 73: 581–599, 1925.

[13] *Endocrinology*, 10: 349–399, 1926.

of the sex-glands to changes of light—the factors directly concerned in causing the changes observed by Professors Rowan and Bissonnette.

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PROFESSOR TROLAND AND DR. KUNZ

THE multifarious activities of such men as Professor Leonard Thompson Troland and Dr. George F. Kunz, both of whom died during the early part of this summer, makes it impossible for a biographical note to refer to all their widely scattered activities. Perhaps you can find space for this brief additional tribute.

Dr. Troland published several important papers on the nature of life and life processes, *viz.*: "The Chemical Origin and Regulation of Life," *Monist*, January, 1914; "The Enzyme Theory of Life," *Cleveland Medical Journal*, 15, 377–389 (1916); "Biological Enigmas and the Theory of Enzyme Action," *Am. Naturalist*, 51, 321–350 (1917). Extensive quotations from these papers are given in a paper by Alexander and Bridges in "Colloid Chemistry, Theoretical and Applied," Vol. II (Biology and Medicine), pp. 18–21. These papers of Troland are well worth the consideration of all biologists.

Dr. Kunz, among his many other social and scientific activities, was deeply interested in chemistry, and at the time of his death was president of the American section of the Société de Chimie Industrielle. He had long been collecting for the American Museum of Natural History specimens of the known chemical elements, and had himself contributed to the nearly complete collection many specimens of historic interest, *e.g.*, part of the rare atmospheric gases first isolated by Sir William Ramsay. On June 28, the day before his death, Dr. Kunz discussed with me matters concerning the American section, and evinced a keen interest in current scientific matters and affairs.

JEROME ALEXANDER

SOME NEW AGAR DIGESTING BACTERIA

DURING the course of some studies on the bacteria responsible for changes brought about in an experimental trickling filter receiving a creamery waste, a number of organisms were encountered which were distinctive in that they digested the agar medium upon which they were grown. A study of these cultures was undertaken in hopes that it might throw some light upon their rôle in the purification process, as well as upon their ability to digest agar.

These cultures were divided into three distinct groups, and since a survey of the literature showed that they had not been previously described, they are therefore described as new species.

Achromobacter pastinator nov. sp: gram negative, non-spore-forming, short rod; motile by means of peritrichous flagella. Colonies small, almost colorless and producing definite liquefaction of agar media. The colonies sink into cup-like depressions in the agar. Acidity is not produced from carbohydrates, although many such compounds are utilized as carbon sources, as shown by chemical analyses.

Pseudomonas lacunogenes nov. sp: gram negative, non-spore-forming, short rod; motile by means of a single polar flagellum. Colonies orange yellow, slightly raised, smooth, butyrous and causing slight depressions in the surface of agar media. No definite liquefaction takes place, although the agar is softened. Acid is rarely produced from carbohydrates, although chemical analyses indicate that many of these compounds are utilized. This organism also utilizes such nitrogen compounds as cystein, asparagin, aspartic acid, tyrosine, alanine, glutaminic acid, ammonium succinate and peptone as sources of both carbon and nitrogen. It also utilizes ammonium sulphate, ammonium chloride and ammonium phosphate as sources of nitrogen, when dextrose is present.

Pseudomonas segne nov. sp: gram negative, non-spore-forming, short rod; motile by means of a single polar flagellum. Colonies orange yellow, slightly raised, smooth, butyrous and causing slight depressions in the surface of agar media. No definite liquefaction takes place, although the agar is softened.

The action of this organism on carbohydrates is identical with that of *Ps. lacunogenes*. There is, however, a marked difference between these two organisms in their ability to utilize nitrogen compounds, *Ps. segne* being unable to utilize any of the nitrogen compounds listed under *Ps.* lacunogenes as a nitrogen source except peptone.

A full description of the morphology and physiology of these organisms will be published elsewhere.

HARRY E. GORESLINE
IOWA STATE COLLEGE

A NEW YELLOW PEROMYSCUS

THE discovery of a new coat color mutation in mammals is sufficiently uncommon to justify its announcement as a special event. We take some pride, therefore, even if we deserve little credit for the production, in making public the discovery of a new dilute yellow (or dilute brown) *Peromyscus*.

The mouse appeared first as a segregant, in a litter of four, in a stock of *Peromyscus maniculatus gambeli*, which was being used in a joint genetic investigation of white spotting in this species. Subsequently, three other similar yellows appeared, all of them

being traceable to a male individual trapped at Silver Lake, Oregon. Since we thus have four yellows, in a total of sixteen young, it appears probable that the character is a simple recessive for which the male in question happened to be heterozygous.

The oldest mouse is now in post-juvenile pelage and appears, in color, to occupy a position between Sumner's yellow and pallid *Peromyscus* and to be comparable with dilute brown agouti *Mus*. The pattern of the individual hairs of the segregant is the same as that in wild mice, but the individual dark pigment granules are brown rather than black. A reduction in the intensity of the black pigment is noticeable also in the normally pigmented portions of the skin. The eyes are less protruding than in wild *Peromyscus*, are quite sensitive to light and appear slightly reddish when well illuminated. The new yellow mice appear to grow as rapidly and to be as vigorous as their normally colored sibs.

R. R. HUESTIS
ELIZABETH BARTO

UNIVERSITY OF OREGON

SCIENTIFIC BOOKS

A Study of the Solar Chromosphere. By DONALD H. MENZEL, with an introduction by W. W. CAMPBELL. Publications of the Lick Observatory, Volume xvii, Part I, 1931.

DR. W. W. CAMPBELL'S photographs of the flash spectrum, made at Lick Observatory expeditions to solar eclipses in 1898, 1900, 1905 and 1908, form the observational sources for Dr. Menzel's study. In a brief introduction the director emeritus of the Lick Observatory and former president of the University of California discusses the "moving-plate" method of recording the flash spectrum, which he invented and effectively used at these eclipses. Pressure of administrative duties compelled him reluctantly to postpone and finally to relinquish the discussion of his flash spectrograms—but the course of research runs so much more smoothly than the conduct of administration that transformations of able research men into able administrators tend not only to restore the social balance but also to advance the ultimate security of research.

Dr. Campbell's "moving-plate" method of observing the flash will remain a primary contribution to eclipse technique. The interpretation of his splendid spectrograms has profited by the delay in discussion, thanks to intervening development of atomic theory; and in Dr. D. H. Menzel he has found a most competent investigator, who has carried the work to completion.

In mid-afternoon of August thirty-first, when the moon's shadow skimmed during twenty-five minutes southeastward from James Bay across Cape Cod, eclipse expeditions, carefully placed along its narrow and unfortunately not wholly unclouded track, attempted again to photograph the instantaneous or "flash" spectrum of the sun's upper atmosphere or "chromosphere." The flash spectrum was briefly seen just at the beginning, and again just at the end of totality, when the chromosphere was visible as a narrow bright changing crescent while the glaring lower photosphere conveniently was hidden behind the edge of the opaque moving moon. The spectrum of this bright crescent, first observed by Young in 1870, has been photographed at every visible eclipse since 1896. Complete success in recording it is very difficult of attainment. Among many attempts, the most notable spectrograms have been secured by Mitchell (Spain, 1905), by Campbell (at the same eclipse), and by Pannekoek and Minnaert (1927).

In the usual "fixed-plate" method of taking flash spectrograms the time-coordinate for the chromosphere's changing crescent is suppressed; the thinness of this uneclipsed crescent after the photosphere is hidden renders a slit unnecessary, and in the direction of dispersion a series of bright parallel arcs represents the composition with respect to wavelength of the light from the upper solar atmosphere. In Campbell's "moving-plate" instrument the time-coordinate is made explicit at the cost of restricting the photograph to the short central sections of these arcs. This is accomplished by placing a long narrow aperture running in the direction of dispersion immediately in front of the photographic plate, and by uniformly moving the plate during the exposure, in its own plane behind the long aperture, at right angles to the direction of dispersion. In the fixed plate spectrograms the lengths of the bright arcs indicate the minimum heights to which the corresponding elements extend above some zero level approximating the level of the photosphere. In the moving plate spectrograms the arcs obviously are replaced by parallel straight lines. The changing intensities of these lines in the direction of motion of the plate yield a multiplicity of interesting data not otherwise revealed. For example, the rare earth lines, and, again, enhanced lines due to ionized atoms, can be picked out by their characteristic appearances—they remain bright well inside the sun's limb, where other lines show as dark against the continuous spectrum of the photosphere. These features are well shown

in enlarged reproductions in numerous excellent plates in the monograph.

A good synopsis of Menzel's study is included in a review by Dr. Theodore Dunham, Jr.,[1] and need not be repeated here in full. Menzel's monograph is very extensive, and is packed with details which have not always been brought into adequate unity. More editing would have resulted in improvement in form and clarity. (The same criticism can be offered of many scientific papers and texts nowadays.) The central purpose of Menzel's study has been shifted toward the theoretical, a little too far perhaps. Owing to the resultant restriction of the space devoted to actual discussion of the spectrograms, the reader in a few places is left in doubt as to what operational links exist between spectrograms and conclusions.

Menzel's discussion of the relative advantages of moving and stationary plate flash spectra exhibits a little excusable partisanship. The comparison, on page 253, of Dr. Mitchell's stationary plate estimates of heights at the 1905 eclipse with those indicated by the Lick moving plate at the same eclipse requires amplification before the conclusions presented can be accepted as final. Like every novelty in technique, the moving-plate method has had to struggle for its "place in the sun." The struggle now admittedly has been won, but, as Menzel is careful to emphasize, the older fixed-plate process has not thereby been displaced. The reviewer ventures to endorse Dunham's suggestion that advantages of both methods ultimately may be retained by taking a true motion picture of the crescent spectral arcs on a very wide film—for example, with a one-second exposure and a rapid jerk between exposures. However, this scheme would introduce new difficulties for the photographic photometry.

In Table I of the monograph Menzel lists normal solar and flash wave-lengths and estimated intensities and flash "heights" of nearly 4,000 lines in Campbell's spectrograms, and for most lines also the moving-plate characters, the spot intensities, the atomic identifications and multiplet designations, where known. This very considerable work occupies 96 clearly printed pages; a valuable separate table (III) of 85 pages reclassifies these data for each element with the lines of each multiplet grouped together, and includes other facts in addition.

Campbell's plates of two or three decades ago were not provided with photometric calibration. Menzel undertook to supply a calibration, and apparently overcame the serious difficulties involved, obtaining quantitative contours which he uses in a discussion of the density gradient and turbulence in the chromosphere. But since even the type of the original emulsion is not certainly known this part of the study may have been overemphasized. It will be well to wait for its repetition at future eclipses, particularly as the motion of Campbell's pioneer plates was not strictly uniform;—and one confidently may expect that Lick expeditions will take a leading part in such repetition.

The flash intensities listed in the Table I represented eye estimates of flash lines. These were used in connection with theoretical intensities to study the abundance of elements in the chromosphere (summarized on page 281). (The method was that developed by Russell in his well-known study of the composition of the reversing layer.) The temperature of the chromosphere was also determined as about 4400° K.

About thirty pages—Chapter IV—are devoted to a critical discussion of the theory of solar and stellar absorption and emission lines. An unusually good bibliography is included. Menzel extends the theory in certain directions. The subject is an exceedingly complex one—in its physical implications as well as in its astrophysical applications; and no completely adequate treatment is possible in the present state of theory and observation. The algebraic intricacies of certain phases of the subject have tempted more than one well-known investigator to develop his equations far beyond the point where the necessary physical and observational knowledge fails; and the resultant discussions must be in part invalid. (To be sure, it is not only in the study of stellar atmospheres that mathematico-astrophysical speculations have outrun the conclusions which would have been drawn by sober and skeptical scientific judgment of the pre-inflationary era!) Menzel attempts to keep relatively close to established physical principles; but it would have been difficult everywhere to make clear the distinction between observational fact and theoretical extrapolation.

Extensive laboratory investigations of the general opacity of a heated gas are in particular badly needed. Again, while contours near the edges of many Fraunhofer "absorption" lines conform to computations based on the hypothesis that the atoms are not absorbing at all, but are scattering like classical "resonators," the central contours are not yet observationally very well determined. One would expect an additional process of true absorption to set in there, involving an equilibrium between the radiant and the molecular kinetic energies, and the theory of such a process still remains somewhat obscure. Not until such physical uncertainties as these have been resolved can a high degree of mathematical refinement be justified in the discussion of the flow of radiation outward through stellar atmospheres.

[1] Publ. Astron. Soc. Pacific, xliv, pp. 111–116, April, 1932.

A large amount of trustworthy information has been derived concerning the abundance, densities, distribution and behavior of the various chemical elements in the atmospheres of the sun and stars. For years to come no student concerned with these interesting matters can afford to overlook this important, vigorously written, and beautifully printed monograph.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

A METHOD FOR MOUNTING SPECIMENS OF DROSOPHILA ON MICROSCOPIC SLIDES

MANY students of the genetics of Drosophila must have felt the need for a reliable method by which specimens could be preserved in their natural condition of coloration and structure. It is especially desirable to keep as permanent records unusual specimens, such as the various types of aberrant flies which are frequently sterile. With the view of meeting this need, the writer has experimented with various methods for mounting flies on microscopic slides. As a result of these efforts, a method has been found that not only preserves the life-like appearance of the fly, but also has every indication of giving preparations of a permanent character. The following brief description of this method is given with the hope that it may be found useful to other workers in the field. It is possible that the method can be employed for mounting other types of insects that are not well adapted to the usual pinning process.

A microscope culture slide with a depth of 1.5 mm has been found to be the best for Drosophila. The concavity is first covered with a thin layer of ever-ready mucilage or glue (Stafford's); then, working under a binocular microscope and with the aid of a pair of dissecting needles, the fly is arranged in the desired position in the center of the concavity. The glue hardens in a few minutes, and serves to hold the specimen in a definite position during the subsequent treatment. As soon as the glue is set the slide is placed in a jar containing equal parts of absolute alcohol and xylene (Baker's) and left for thirty minutes. It is then transferred to absolute alcohol and left for at least three hours. The preparation is completed by filling the concavity with Euparal (Grubler's) and applying a cover glass.

If the best results are to be obtained, it is necessary to take the following precautions: (1) The slide must be absolutely clean, otherwise the glue will crack loose and allow the fly to float off in the liquid. (2) The specimen to be mounted should be at least two days old. Newly emerged or young flies tend to become distorted in the alcohol-xylene mixture. (3) It is desirable to prevent the fly from making any movements before the glue has hardened. This can be done by holding a small wad of cotton, saturated with ether, just above the fly for the two or three minutes that it takes for the glue to set. These preparations have the advantage of permitting examination of both the upper and lower surfaces of the mounted specimen, and if it be desired, a drawing can be made at any time.

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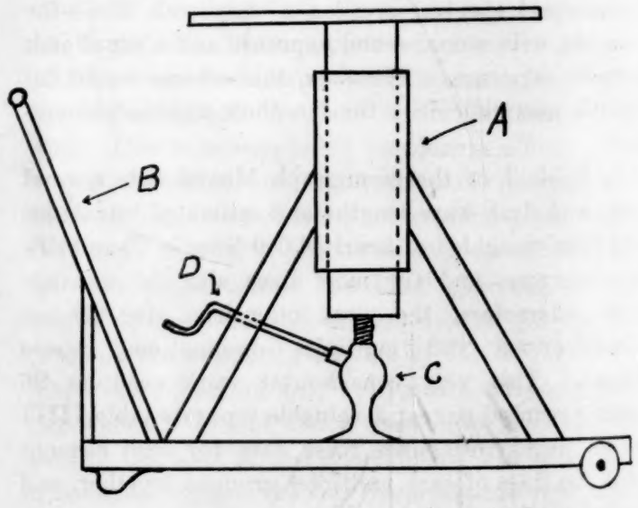
AN ADJUSTABLE APPARATUS STAND AND TRUCK

THE average laboratory apparatus stand is quite unwieldy with regard to height adjustment and mobility if the stand is loaded with a heavy piece of apparatus. It is true that some stands are equipped with rack and pinion for adjusting, but the cost is usually prohibitory.

In order to overcome these difficulties in case of a small spectrograph, which it was desired to move quickly from one part of the laboratory to another and to adjust in height, the scheme shown in the figure was adopted.



An ordinary laboratory stand A was mounted on a very low truck provided with rubber-tired wheels in front and sliders at the rear. A handle B was provided for easy manipulation. An ordinary automobile jack C was used as the means of raising the adjustable part of the stand The jack used was of the "double extension" type, giving a lift of about 8 inches. Since the height of the stand at the lowest point was arranged to be about that of an average

laboratory table, 8 inches lift was quite adequate for most purposes. The adjusting handle D was arranged so that a person seated and looking through a spectrometer would find no difficulty in making the necessary height adjustment. The stability of the truck for photographic purposes is excellent.

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SPECIAL ARTICLES

GROWTH RATES AND RACIAL SIZE IN RABBITS AND BIRDS

IT is a thankless task to try to correct an error which has crept into scientific literature, but at times necessary, unless error is to be allowed to continue indefinitely. A case in point I find in the work of a former pupil who was allowed to study observations of my own upon the growth rate of rabbits and to publish conclusions based upon them in which I am unable to concur. To be specific, I find in a recent interesting and important paper by Riddle[1] and others this statement, "Robb found that the percentage growth-rate from birth to puberity is the same in these two races of rabbits, but after puberty this rate is more depressed in the small race." The two races mentioned in the quotation are my own Flemish Giant (large size) and Polish (small size) races, and the data used by Robb were supplied from observations which I had personally made and they were later published elsewhere in greater detail.[2] Robb[3] says (p. 308), "During the fourth month Polish and hybrid animals undergo a more rapid retardation of growth than do the Flemish Giants. Their growth rate values, *which have been indistinguishable hitherto* (italics mine) diverge at this time." The point which I wish to emphasize is that the growth rates are *not* identical in the large and small races at any time, either subsequent to birth or prior to it, as shown by Castle,[2] and Castle and Gregory.[4] The large race not only undergoes cell division prior to birth faster than the small race but also grows at a faster rate after birth, so that the growth curves of the two races steadily diverge. Nor is the percentage increase in weight by 10-day intervals the same in the two races as Robb suggests. This is shown in detail in my Table 4 (1929, p. 433)[2] from which I will reproduce the data for females only (the largest group).

TABLE

PERCENTAGE INCREASE IN WEIGHT BY 10-DAY INTERVALS OF LARGE RACE AND SMALL RACE FEMALE RABBITS

Age in days	Large	Small	Difference
0– 10	221	207	14
10– 20	72	67	5
20– 30	67	70	–3
30– 40	45	34	11
40– 50	25	22	3
50– 60	20	16	4
60– 70	16	15	1
70– 80	15	12	3
80– 90	13	11	2
90–100	12	9	3
100–110	11	8	3
110–120	9	5	4
120–130	9	6	3
130–140	8	4	4
140–150	7	3	4
150–160	6	4	2
160–170	4	2	2
170–180	4	3	1
180–190	4	4	0
190–200	3	1.6	1.4

Except for the single age group (20 to 30 days), the growth rate of the large race is consistently higher. For some statistical reason which I can not explain the small race gain in that period is apparently higher, but it falls back into its proper place of more retarded growth rate in the next period (30 to 40 days) and there remains. In his zeal for "the equation for autocatalysis sponsored by Crozier" Robb overlooked the consistent difference in growth rate between the large and small races, and assumed the existence of two distinct growth cycles. I had hoped that my own publication of the complete data without comment would be a sufficient correction of Robb's mistake, of which I was not aware until I came to study the data myself, subsequent to the preparation of his manuscript, but since his conclusions rather than my own are accepted by even such veteran investigators as Riddle, I think it imperative to point out that the two are inconsistent. Dr. Robb will, I am sure, acquit me of any ill will, either in seeming to have been a too lax critic of his own work in advance of its publication or a too severe critic afterward.

The important general conclusion to which all our studies of size inheritance in rabbits point is that differences in adult body size are determined primarily by different growth potentials inherent in the gametes (eggs and sperm) of each race. The effects of these

[1] O. Riddle, D. R. Charles and G. E. Cauthers, *Proc. Soc. Exp. Biol. and Med.*, 29: 1216–1220, 1932.

[2] W. E. Castle, *Jour. Exp. Zool.*, 53: 421–454, 1929; *ibid.*, 60: 325–338, 1931.

[3] R. C. Robb, *Brit. Jour. Exp. Biol.*, 6: 292–310, 1928.

[4] W. E. Castle and P. W. Gregory, *Jour. Morph. and Physiol.*, 48: 81–104, 1929; SCIENCE, 73: 680–681, 1931; *Jour. Exp. Zool.*, 59: 199–211, 1931.

differences in growth potential are manifested first in differences in rate of segmentation of the fertilized egg, then in differences in the size of the blastocyst and of the embryonic area which develops upon it, later in difference in size of the young at birth and in (percentage) growth rate subsequent to birth, and finally in a more prompt and complete arrest of growth at puberty. Robb was able to show that differences in size of the endocrine glands are correlated with differences in general body size and so that differences in endocrine activity are probably not responsible for the differences in adult body size. This started Gregory and myself on a search for the causative agency elsewhere and we think that by a study of the embryology we have located it in the gametes.

If Robb's statement were correct that there is no difference in percentage growth rate between large race and small race rabbits prior to puberty, it would present an exceptional situation requiring explanation. As it is, all the facts of embryology, of size at birth, of post-natal and post-pubertal growth are consistent and referable to a common agency inherent in the gametes at the time of fertilization.

The observations of Riddle and others on birds indicate that a similar situation exists there also with only this complication, that size on hatching (unlike birth weight in mammals) is absolutely limited by the size of the egg (including everything within the limy shell). It seems probable, therefore, that racial size in vertebrates generally is determined by constitution of the gametes, and that endocrine glands enter only as secondary agencies in modifying the growth rate in the later stages of the life cycle.

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CULTIVATION OF THE VIRUS OF INFECTIOUS LARYNGO-TRACHEITIS OF CHICKENS

THE ability of certain viruses, *e.g.*, vaccine virus, Virus III and herpes virus, to multiply in a fluid medium has been demonstrated by the work of Maitland and Maitland,[1] Eagles and McLean,[2] Andrewes,[3-5] Maitland and Laing,[6] Li and Rivers[7] and others. The report to be made here is concerned with the results of the application of methods used by some of these investigators in the cultivation of the virus of infectious laryngotracheitis of chickens.

The medium devised by Li and Rivers[7] for the cultivation of vaccine virus, consisting simply of minced chicken embryo and Tyrode's solution, has proved satisfactory and has been used most extensively. The containers used were 50 cc Erlenmeyer flasks, with cotton stoppers, over which were placed two layers of lead foil. In each flask, 0.5 cc of minced embryo and 5 cc of Tyrode's solution, sterilized by filtration, were placed. Bacteriologically sterile Berkefeld V filtrates of an infusion broth suspension of tracheal exudate obtained from an infected chicken were used to initiate the cultures. Sterile emulsions of spleen tissue from infected chickens were also tried, but without success.

To start a culture, 0.5 cc of filtrate was added to each flask of medium. New cultures were made at five- to seven-day intervals by the direct transfer of 0.5 cc of the old culture into flasks of fresh medium. The cultures were tested for the presence of virus by the injection of 0.1 cc into the tracheas of susceptible chickens. In this manner, active virus has been demonstrated in a number of cultures that were separated from the original culture by a sufficient number of generations that virus could be present only by reason of multiplication. In only one series of cultures has virus been present beyond the twelfth generation. In this series, which is still carried, virus has been demonstrated in cultures of the twenty-second generation. In this instance, the multiplication of virus is more than 5×10^{23}.

It has been proved that virus may be present in some, but not all, flasks of media of the same generation of cultures. Therefore, in the tests for virus, it has been necessary to make inoculations separately with the contents of several flasks. The virulence of the culture virus has been observed to equal that of the virus filtrate with which the cultures were initiated.

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